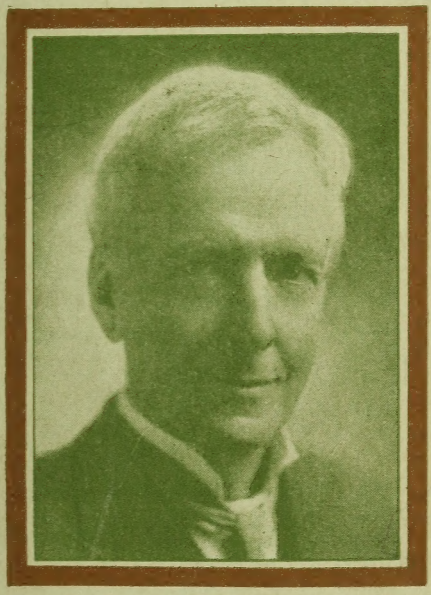
HALF-HOUR EXPERIMENTS WITH PLANTS



By

LUTHER BURBANK

WHETHER the growing of plants be taken up as a science, a profession, a business, or merely for recreation, there is ever present the need to understand nature's methods and her forces in order to be able to make use of them—to guide them.

The purpose of this booklet is to afford a glimpse of the interest and value of the works of Luther Burbank, the "wizard of the plant world." In the new Burbank books are facts about plants stranger than fiction; expert guidance in every detail of plant culture; interpretations of the laws and principles of nature, with specific recommendations as to how nature's ways may be put to practical use for pleasure and profit; and the inspiration and priceless secrets of the world's foremost plant creator—the sum total of his unparalleled experience and skill.

But remember that what is included here is only a taste, a thousandth part of the whole treasure that may be yours if you own the complete library.

Half-Hour Experiments

What to Work For in Experiments With Plants

The Practical Essentials of Hand Pollenizing

How to Burbank Your Geraniums

How to Make Old Fruit Trees Young and Productive

THE ordinary garden methods may be had from any one of a hundred sources. But practical and dependable guidance in the field of plant experimentation is most difficult to obtain. In this but partially explored field that offers unlimited possibilities for pleasure and profit, Luther Burbank is best qualified of all contemporary plant breeders to point the way to success. Appeal to authority in plant improvement means appeal to Burbank, the dean of plant breeders.

The half-hour experiments appearing in this booklet are from the works of Luther Burbank. They are experiments that you may actually put into practice in your garden or orchard, and may be relied upon as authentic.

At the Door

FLOWERS offer the most inviting field for the amateur, even while they still hold their full attraction for the practiced experimenter.

There is opportunity for skill in the blending of different shades in a flower, far greater than the painter's skill in applying colors to the canvas.

Even the flowers that grow beside my home are always undergoing observation and being tested as to their capacity for further education. So pictures taken in different seasons do not have the same appearance. At the moment, this beautiful rose has the place of honor as the decoration selected for the porch.

—LUTHER BURBANK.

The color illustration shows the door to Burbank's home in Santa Rosa. Does your own look anything like this? Have you exhausted all the possibilities for pleasure and beautiful results from knowing about and working with flowers?

What to Work for in Experiments with Plants

NATURE has been carrying on selective, world-wide breeding of plants and animals on a constantly widening scale for millions of years: but nature does not care for sweet corn; thin-skinned, seedless, juicy oranges; head lettuce; self-blanching celery; double roses; or the farmers' crops of varied grains and potatoes which now are, in most cases at least, a hundred times as productive and of almost infinitely improved qualities.

Man has, at first unconsciously and later consciously, produced all these marvelous improvements and ten thousand others and is now making and will make improvements in everything, plant and animal, which is useful to him. Nature has time without limit, but man has immediate need for better and still better food and must take a hand in hastening and directing plant improvement.

Immediate possibilities for plant improvement outnumber the improvements which have already been wrought, a thousand to one. It would be impossible here to begin to catalogue the improvements which can be wrought—improvements in size, shape, color, texture, juiciness, flavor, sweetness, or chemical content of fruits; improvements in the appearance, tenderness, taste, cooking qualities, and nutritive elements in vegetables; improvements in length and strength of fiber in cotton, flax, hemp, and in many other textile plants; improvements in the quantity and quality and color of grains; improvements in amount and value of the chemical content of sugar beets, sorghum, coffee, tea, and all other plants which are raised for their extracts—improvements all of them, which are capable of turning losses into profits, and of multiplying profits, instead of merely adding to them by single per cents.

Improving the yield, and consequently the usefulness and profit of existing plants, however, is but the beginning of the work before us. An almost equally rich field lies in saving plants from their own extravagances. Under this head might well come the large subject of bringing trees

to early fruiting, or of greatly shortening the period from seed to maturity in shade and lumber trees. The rapid-growing walnut, and pineapple quince, and chestnut seedlings bearing at six months from the seed, stand forth as strong encouragement to those who would take up this line.

Then there is the broad subject of adapting plants to special localities. The hop crop of California, the cabbage crop near Racine, Wisconsin, the celery crop near Kalamazoo, the cantaloupe crop at Rocky Ford and Imperial Valley, and the seed farms of California—all of these bear eloquent testimony to the profit of a specialty properly introduced.

Yet we have not touched on the most interesting field in plant improvement — the production, through crossing, hybridizing and selection, of wholly new plants to meet entirely new demands.

All of these things are as immediate in possibilities and consequences as transcontinental railroads were fifty years ago. All can be made to come about with such apparent ease that future generations will take them as a matter of course.

The cost and the quality of everything that we eat and wear depends on this work of plant improvement.

—Luther Burbank.
(Vol. I, p. 260-277)

Among the outstanding methods of plant improvement are pollination, grafting, and budding. The first steps in practical work explained in this booklet are the methods Luther Burbank has successfully employed in thousands of separate experiments.

The Practical Essentials of Hand-Pollenizing

THE essence of pollenizing is merely the transfer of pollen from the stamen of one flower to the stigmatic surface at the end or rarely at the side of the pistil of another. This is the work that is ordinarily accomplished by the insect. It is all that the plant experimenter accomplishes when he wishes to effect the crossing of different plants of the same species or the wider crossing, commonly called hybridizing, of different species.

There is nothing occult in the practice of the bee or in the imitation of his work as practiced by the hand of the pollenizer. What is accomplished in each case is the purely mechanical transfer of a certain number of minute pollen grains from one place to another. Beyond that, everything depends on the vital activities of the plant tissues themselves. Specific methods are necessary to effect cross-pollenizing in the case of sundry types of flowers that have developed blossoms curiously modified as to form or details of structure. But the general processes of hand-pollenizing as they apply to the chief flowers of the orchard and garden, may be stated in a few words.

The essential thing is to secure a certain quantity of pollen, usually by shaking it from the flower on a watch crystal or other small receptacle, and to transfer this pollen to the receptive pistil of another flower either with the finger tip—which furnishes in general the most useful piece of apparatus—or with a camel's-hair brush. It is desirable to cover the receptive portion (stigma) of the pistil fully with pollen, partly to insure complete fertilization, and partly to prevent the vitiation of the experiment through possible subsequent deposits of pollen from another source.

If the flower to be fertilized has stamens of its own, these should be removed before they are fully ripe—which is often a few hours or a day before the foreign pollen should be applied. This removal of the stamens may usually be done with a pair of small pinchers. In case of flowers that have short pistils—the cherry, apple, and other orchard fruits being good examples—the unopened flower

bud may be cut around at about the middle with a thin-bladed knife, the anthers being thus excised at a single stroke.

So-called composite flowers, however, require special treatment. The daisy and the sunflower are familiar examples. Here the true flowers are very small and grouped in masses. Individual treatment is usually out of the question. The best method is to wash away the pollen with a carefully directed stream of water from a garden hose, or by spurting water from the mouth; after which the head of the pollenizing flower is rubbed against the one selected, thus effecting fertilization en masse.

In exceptional cases it may be desirable also to cover the fertilized flower with a paper bag to prevent the visit of insects; but in practicing pollination on a large scale this may usually be omitted by those who have experience enough to recognize the hybrids from the others. If the stigma has been satisfactorily covered with pollen, it will present no exposed surface for the reception of other pollen grains.

The rule is simply this: Seek nature's plan and follow it. In other words, take a lesson from the bees, and pollenize the flowers somewhat as they do. Bear in mind the essentials of the process, which are the same for every flower. Study the mechanism of each new flower and adapt your precise method to the needs of the individual case. It does not matter just how the pollen reaches the stigma, provided it does reach it.

Any amateur who wishes to test the matter may do so to his complete satisfaction by making the simplest experiment in cross-pollenizing and watching the growth of the hybrid his work brings forth. A very short course of practice will give you the knack, and will lead to surprising, fascinating, and perhaps far-reaching results.

—Luther Burbank.

(Vol. II, p. 261-266)

For an initial experiment try hybridizing your geraniums, after reading Burbank's instructions in the following article.

How to Burbank Your Geraniums

WHY single out the geranium for your first experiment in pollenizing? Burbank gives the following reasons for recommending the plant to his amateur disciples and suggests the possibilities in working with this common flower which almost everyone grows in his garden or window box.

"Some of my experiments in hybridizing have been conducted with the idea of producing fragrant races of geraniums. The chief difficulty in this work is that most of the fragrant geraniums have been grown for such a length of time from cuttings that they have for the most part lost the power of producing seeds. This makes it obviously difficult to secure seeds from the plants that are precisely the ones it would be desirable to use for the purpose.

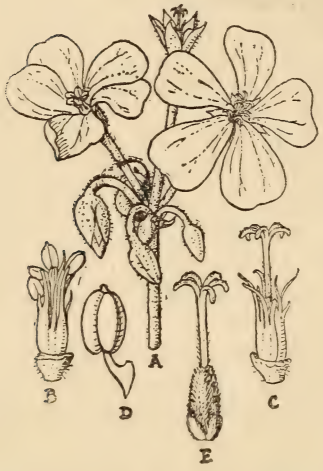
"Nevertheless, I have produced a number of varieties having fragrance, of very attractive new qualities. One of these fragrant varieties is developed from a compact-growing Australian form which produces an enormous amount of seed. This fragrant variety, which I have named Coconut Geranium, has a most pleasing fragrance and is unusually hardy and handsome in growth and foliage. Bearing as it does an abundance of pollen, it was used to pollinate the well-known Rose Geranium so much used in perfumery, and which never bears seed. But by the use of pollen of the Coconut Geranium, seeds were produced on the Rose Geranium by which a whole new series of variously perfumed geraniums are now growing. I also worked at one time in selecting the geraniums for the production of large flowers of dazzling brilliant scarlet color, and with a good measure of success.

"It will thus appear that there is abundant opportunity for improving the geraniums, even by working with the species ordinarily under cultivation. However, the best opportunity for work in this line will involve hybridizing experiments in which the exceedingly hardy wild species are utilized. It should be possible thus to produce new races of geraniums that have altogether exceptional qualities.

"The wild species include some that are white in color as well as those that are pink or white striped with pink or with reddish veins. So there is opportunity to have a wide choice as to color variation. The cross might likely result also in giving the geraniums enhanced vigor, so that new races of perpetual bloomers would be produced."

(Vol. VII, p. 182-184)

"The Practical Essentials of Hand Pollenizing" (See pages 5-6), gives the details of the simple, yet practical, methods by which hybridizing is accomplished. The diagram below shows the construction of the geranium, and should be of further assistance in your work. It remains only for you to apply these methods to the geraniums you have chosen for your experiment.



(A) Inflorescence of a geranium; open flower on left showing condition with mature anthers and immature pistil; open flower on right showing condition with mature pistil and faded (defunct) anthers.

(B) Stamens and pistil from left-hand flower, enlarged.

(C) Pistil with stamens removed, enlarged.

(D) Mature stamen, enlarged.

(E) Mature pistil showing ovary, always included in stamen-tube, style, and radiating stigmas, enlarged.

Few plants among all the popular favorites have greater merits than the geraniums, and none perhaps offers better opportunities for interesting experiments that may be made by the amateur.

—LUTHER BURBANK.

Old Trees Made Young

"WHAT kind of a tree is that?" asks a neighbor, as he leans over the fence. "Why, it is hardly fair to speak of that as a tree; that is a concentrated, double-barreled prune experiment. If I were to name all the varieties of fruit that are growing on the branches from that single trunk, it would sound like reciting the names from a nursery catalogue. Nearly all my important experiments in developing a particular variety of cherry, plum, peach, apple, almond, nectarine, quince, apricot, nut, or timber tree are made, at one stage or another, in these tree colonies."

Of course, the average person who inspects my farms has no thought of becoming an experimenter on a large scale and there would be no occasion to practice multiple grafting and regrafting on any such scale as that employed at the Gold Ridge farm. But I call particular attention to this matter of fruit-tree grafting, because there is a lesson in it not merely for the commercial grower of fruit, but for tens of thousands of persons scattered across the length and breadth of the country who have in their gardens a few fruit trees, at present of no apparent value, that might be made to bear good fruit in abundance.

Moreover, there are other thousands who have on their farms neglected orchards, run riot with weeds and bringing no monetary return whatever, which might be made the most productive and valuable portions of the entire acreage. And in each case the grafting of good varieties of fruit on the old and otherwise worthless stock is the key to the entire situation.

Fortunately the facts of the situation are now being called to the attention of the general public, in particular by the workers at the agricultural experiment stations. Bulletins are being issued that call attention to the possibilities of rejuvenating old orchards, and in many regions results of this work are being manifested in the restoration of these abandoned orchards. In one county in Ohio, in a recent season, 117 rejuvenated orchards added more than fifty thousand bushels to the apple crop. "In several cases," says the Ohio report, "a net profit of $400 per acre has been secured from an abandoned orchard." The report

continues: "It is like reaping where one did not sow to bring one of these orchards into its own again. An investment in one of these orchards is better than gold-mine stock, for there is no 'luck' about it. If there is any risk about operations of this sort, it is because of lack of business capacity and industry."

—Luther Burbank.

(Vol. III, p. 99-103)

There is not space enough here to begin to present the details as to the exact methods of operation through which restoration and rejuvenation of old orchard trees may be brought about. The important questions of pruning, tree carpentry, soil and nourishment, and battling pests are all taken up at length by Burbank in his works.

As Burbank states in the foregoing excerpts regarding orchard rejuvenation, "the grafting of good varieties of fruit on the old and otherwise worthless stock is the key to the entire situation." Because of this fact, we give in the following pages, Burbank's statements of the general principles of grafting and the more common methods, which will afford a foundation for experiments that will prove fascinating and profitable.

In one county in Ohio, in a recent season, 117 rejuvenated orchards added more than 50,000 bushels to the apple crop. In several cases a net profit of $400 per acre has been secured from an abandoned orchard.

MORE THAN 500 KINDS ON ONE TREE

The direct-color photograph on the opposite page shows one of Burbank's cherry trees which has produced as high as 500 kinds of cherries at the same time—this for the purpose of convenient comparison and intelligent selection.

Grafting Methods That Will Work Miracles

General Principles

THE single principle that underlies all successful grafting, is that the layer of tissue called the cambium layer, lying just beneath the bark of the twig, shall be brought in intimate contact with the corresponding layer of tissue of the stock on which it is grafted. The life-giving sap flows through this thin layer of tissue only. As to the central woody tissues—the so-called heart of the twig—there will be no union between stock and cion in any case.

But this is of no consequence since the new growth of wood soon covers the trivial wound with which the cambium layer will make ready union under favorable circumstances; and the growth will continue outward, year by year, until ultimately the cion and stock are so firmly joined that they constitute a branch as strong as the ungrafted branches of the tree. But unless the living tissues of the cambium layer are accurately joined, no union can take place, and the graft will be a failure. If this essential principle is borne in mind, the process of grafting becomes a comparatively simple one, and one that may be carried out successfully by amateurs with very little preliminary practice.

A few specific hints as to the details of the method may, however, be of service. So I shall give a brief account of the methods employed in my orchards, where the process of grafting is carried out thousands of times each year.

Grafting may be divided under three headings: (1) Grafting proper, in which a cion or small shoot is inserted into or upon the stock; (2) Inarching, in which the cion is left attached to its parent stock until union with the new stock is completed; (3) Budding, which consists of the insertion of a single bud upon the cambium layer of the stock. There is no fundamental difference between the three processes; they are merely different methods of accomplishing the same purpose.

Grafting may be more or less successfully carried on at any time of the year. But during the spring and early summer months the vital cambium zone is usually at the

maximum of activity, forming wood tissue from its inner surface and bark from its outer surface. At this time of maximum growth, wounds are rapidly healed, and union between a cion and stock is most rapidly secured. Nurserymen and fruit growers take advantage of this fact.

The most gratifying results almost always follow spring grafting or summer budding. It is necessary, however, that there should be activity enough in the sap movement to form the cellular connection between the stock and the bud before the latter perishes from drying out; sap flow is also necessary to allow the bark to be lifted readily from the cambium for the insertion of buds.

The best success usually follows the grafting of mature, or nearly mature, buds in the case of trees and shrubs; though young tender buds often thrive nearly as well.

The More Common Methods

The best and quickest way to graft young seedlings is by "side" grafting. This graft is made by taking a piece of the new wood from the tree to be multiplied, about 2½ inches long, with well-formed buds on it. Slice off both sides of the lower end of the graft in the form of a sloping wedge, the cuts on each side being not much over one inch long. Both sides should be alike, but one of the edges should be thicker than the other.

The tree to be grafted is bent to one side with the left hand. With the right hand a sloping gash is made downward on one side of the tree just above the ground, and the graft, described above, is pushed down into this cut as far as it will go. The cambium layers of the cion and seedling meet at some point, and a union with the tree is formed. After the cion has been placed, the tree is allowed to spring back to its upright position, and is at once cut off with a pair of pruning shears, about two inches above the graft.

In grafting cions on the branches of trees, as in transforming large trees or whole orchards, the so-called "cleft" graft is usually employed. In preparing for this, the branch of the stock tree is sawed off at a convenient place, the exact position being determined by the character of the experiment. If we are seeking to make a permanent tree, the graft is implanted upon the limb not more than a foot

or two from the trunk. But where it is intended merely to test the cion as to its fruiting possibilities, time being an object, it is placed far out among the smaller branches by what is called the "tongue," or "whip," graft.

In sawing limbs over an inch thick to serve as stocks, care must be exercised that the limb does not split. In order to avoid this, saw part way through from the bottom, and finish it by sawing from the top. Most persons who graft do not trim the stock after it has been cut, but I have found that the cambium layers join much more readily if the top of the stock is trimmed carefully with a knife, so that it is smooth all around the edges. Clean incisions heal best with vegetable as with animal tissues.

In making the "cleft" graft, the stock is split with a grafting tool. The wedge-shaped portion of this tool is for the purpose of holding the cleft open until the cions have been inserted. The cions are cut and connected with the bark usually one on each side of the cleft. When the tool is removed, the sides of the stock hold the cions tightly, so that it is seldom necessary to tie a string or piece of cloth around the graft. It is usually best to put on a piece of cloth, however, after waxing. This insures more uniform results.

Grafting wax, a formula for which will be given presently, is usually applied several inches below the crack which was made for the cleft in which to insert the cions.

In some cases, however, the stock will later crack below the point where the grafting wax was applied, and when this occurs there is danger of the graft dying. For this reason it is wise to examine the grafts and where any open crack is found, additional wax should be applied.

Grafting-Wax Formula

Mention has been made of grafting wax, as being very generally used to protect cion and stock during the progress of healing and union of tissue. After testing many formulas, I selected the following, and no other has been used for many years.

Eight pounds of common resin and one pound of beeswax or paraffin (either will do if no acid or alkali is present, though beeswax is generally preferred) are mixed with one

and a half pounds of raw linseed oil. Boiled oils often contain chemicals injurious to plant life. If the wax is to be used in cold weather, it is better to use only seven and a half pounds of resin and a half pound of beeswax in the mixture, thus giving slightly thinner consistency.

The ingredients are slowly heated together until the resin and wax are melted and all thoroughly combined. This composition when partly cooled is poured into pressed tin pans, to make cakes of convenient size for handling. The mixture sticks to the tin with great persistence; but by turning the pan upside down and pouring boiling water over it the wax can be shaken from the pan.

These cakes are broken into pieces of convenient size, and in use the wax is kept warm in any convenient dish or pan having a short strong handle. The wax may be heated over a small coal-oil stove, and when applied to the grafts should be much warmer than can be borne by the hand, but not hot enough to scald the plant tissues. If heated in a double heater, the danger of overheating is lessened.

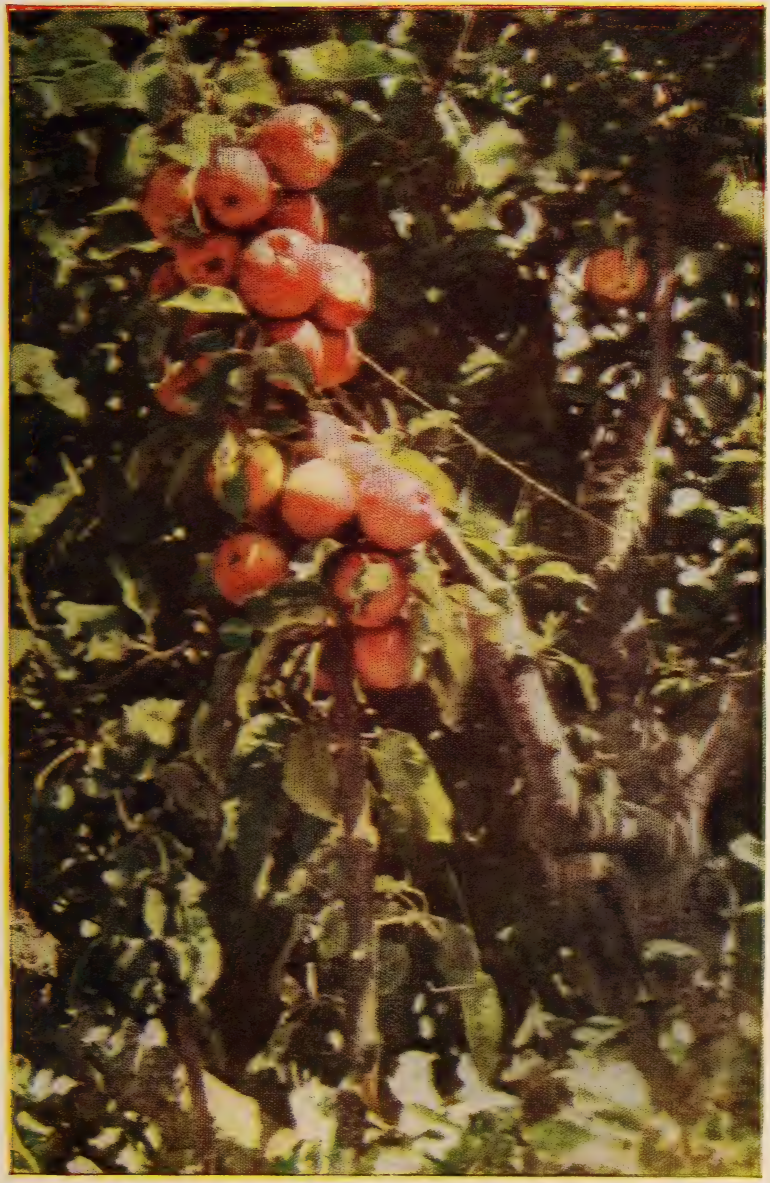
If applied with care with a small paint brush, first around the thick bark of the stock, and later, as the wax on the brush cools, on and about the cuts and open joints, no harm will result. The plan of brushing the hot wax about the graft, instead of applying it by the fingers in the tedious old-fashioned way saves nine-tenths of one's time, and does far better work than could ever be done by the old method.

If the wax should prove to be too soft and sticky, as is sometimes the case in very warm weather, melt it over again with more resin added. If too brittle, add a little more linseed oil so as to bring it to the right consistency to spread well, and at the same time "set" well on cooling. It gives the most satisfactory results when about the consistency of ordinary chewing gum. —Luther Burbank.

(Vol. II, p. 309-322)

An Apple Graft One Year Old

As evidence of the success of Mr. Burbank's methods in producing quick results, the apple graft illustrated on the opposite page, shown in full bearing after only one year's growth, speaks eloquently.



When Burbank Was Just a Beginner

THE picturesque New England town of Lancaster, Massachusetts, was a rendezvous for ministers, lecturers, and teachers, and was charged to an unusual degree with intellectual activity. Into this environment, March 7, 1849, was born Luther Burbank, the thirteenth child of Olive Ross and Samuel Walton Burbank.

Luther was a quiet, serious child, whose most noticeable trait was a love for flowers that amounted almost to reverence. From his earliest boyhood he studied plants, trees, fruits, garden vegetables—in fact, everything that grew from the earth.

But plants did not demand his entire attention. He received an excellent fundamental education at Lancaster Academy, took great interest in chemistry and mechanics, learned the useful trade of carpentry, and for a time worked in a factory near his home. At twenty years of age, Burbank decided that a physician's profession would be most congenial as a life work, and began the study of medicine. However, the death of his father caused him to abandon this purpose.

Soon after Samuel Burbank's death the family moved to Groton—now known as Ayer, Massachusetts; and Luther purchased a seventeen-acre farm in the nearby village of Lunenburg, to be used for raising seeds and garden products. This was the beginning of definite experiments with plants.

The Burbank potato, Burbank's most famous product, also his first, was evolved largely by accident in his early experiments on the Lunenburg farm. A rare seed-ball of the Early Rose potato afforded the material which made possible this valuable discovery. Burbank planted the twenty-three tiny seeds the ball contained and selected one of the resulting plants as possessing the best qualities.

In 1875, after three years at Lunenburg, Burbank suddenly decided to move to California.

Ten Burbank potatoes, retained by their originator and constituting Burbank's most tangible asset in beginning his

new career in California, were planted on his brother's farm, and the entire product of the first season was saved and replanted; so that by the end of the second season the stock was large enough to offer for sale.

But victory was not won without an heroic struggle and years of persistent effort, for it should be remembered that Burbank was blazing a new path—a path that others may now follow with comparative ease, since he has cleared the way.

During the fourth year at Santa Rosa an incident of momentous importance occurred, an event that proved to be the definite turning point toward marked success. Burbank received a "rush" order from Mr. Warren Dutton, a wealthy merchant and banker of Tomales, who had become suddenly interested in prune growing and wished to undertake it on a large scale with the least possible delay. Mr. Dutton required 20,000 prune trees to be produced in a single season.

Though this was an unprecedented task, Burbank brought his ingenuity and resourcefulness to bear on the problem, and solved it to the consternation of a skeptical world. By placing French prune buds on the required number of almond seedlings, which sprout almost as readily as corn, the miracle was accomplished, and within the time specified. Never before or since, so far as is known, was a two-hundred-acre orchard developed in a single season.

At this point Burbank ceased to be just a beginner and entered the ranks of the successful plant breeders. The prune experiment served to advertise his work locally, and by cumulative degrees his fame spread throughout the nation and eventually became worldwide. By the end of the tenth year in California, the quality of the products and reliability of the Burbank "Santa Rosa Nursery" became so widely known that he was selling over $16,000 worth of trees and plants per year.

As the World Knows Burbank To-day

THE pioneer in any new line of thought is usually first ridiculed and frowned upon; then abused; later endured and pitied; and afterward accepted as an oracle. Such was the lot of Luther Burbank, but with patience and fortitude, not heeding the skeptics and cynics, he struggled forward from the humble position of lowliest beginner to the envied heights of the world's foremost plant breeder.

Burbank and Edison

Luther Burbank holds much the same place in the hearts and admiration of his fellow men as Thomas Edison. They have a great deal in common. Both are known as "wizards" and "geniuses," whereas their accomplishments have been chiefly the reward of hard work with intelligence to guide them; both have passed the traditional three score and ten years and are still tremendously keen in their enjoyment of life and work.

Thousands of people make pilgrimages to Burbank's experimental farm at Santa Rosa, in the hope that they may be permitted to see and talk with the famous "Plant Wizard." Visitors were welcomed until Burbank found it impossible to carry on his work and still meet personally the rapidly increasing number, many of whom had journeyed far to confer with him and to learn his methods. Among these were men and women prominent in literature, art, science, education, finance, those connected with governments of most foreign lands, and many whose names are familiar in song and story.

During the last ten years he has spared the time to see but few of those desiring an interview. Invitations to write and to lecture in this and other lands have necessarily been declined by him. He is too busy making plant history to devote his valuable time to public appearances or to playing host to visiting admirers.

A Glimpse of a Unique Genius

Although the name of Luther Burbank is familiar throughout the whole civilized world, and even where civili-

zation is but partial, yet very few appreciate fully how strenuous and comprehensive has been his work.

By practice and concentration, Burbank has developed his mental and physical powers to a most unusual degree. After fifty years of grueling and continuous effort, he is now able to conduct simultaneously and keep fully familiar with every detail of thousands of different experiments.

The responsiveness of the senses to conscious training is dramatically demonstrated by the following true incident which occurred at Santa Rosa. Some years ago Mr. Burbank passed a bed of verbenas just coming to blossom. Suddenly he stopped, dropped to his hands and knees and began crawling through the verbena bed. He had noticed the familiar trace of the delicate trailing arbutus odor coming from unscented verbenas. He searched until he had located the plant sending it forth, and then was ready to begin the production of a sweet-scented verbena. Yet Burbank says: "There is no magic in it; every person equipped with a good nose and a good pair of eyes can reach the same sensitiveness."

As a demonstration of his invincible patience when striving for a desired improvement, his work with the daisy may be taken as typical. In developing the Shasta Daisy, Burbank produced millions of plants and blossoms, destroyed ninety out of every hundred, and continued with the seeds of the survivors until he had developed the exact product he had visualized.

The great plant breeder spares neither time nor effort when working out his theories. He has recently completed an experiment, the result of which attracted nation-wide attention. Eighteen years ago he began, and has lately completed, the arduous task of retracing the evolution of corn from the Indian grass teosinte. By nature's unaided and undirected processes it had taken generations to accomplish the evolution.

No Magic Wand

Like Antæus, Luther Burbank lives close to the soil and receives new strength from daily contact with it. He carries no wizard's wand, possesses no magic power. What he

has done he has accomplished, despite the handicaps of ill health and abject initial poverty. And he assures others, if they have the will, patience, and persistence, they can reach the heights he has attained.

Tributes by Contemporary Scientists

The ardent admirers of Burbank are legion. He is one of America's most beloved and notable figures, and not only as a plant breeder, but as a scientist of first rank and a great public benefactor.

The following appreciations by several eminent contemporary scientists have special value coming as they do from men supremely qualified to judge or to give praise:

DR. HUGO DE VRIES,
Botanist of the University of Amsterdam.

> "A unique, great genius! To see him was the prime reason of my coming to America. He works to definite ends. He ought to be not only cherished but helped. He should be as well known and as widely appreciated in California as among scientific men in Europe."

DR. VERNON KELLOGG,
Internationally Famous Geologist and Naturalist.

> "The final and most important factor of Burbank's success is the inherent personal genius of the man, his innate sympathy with nature, aided by the practical education in plant biology derived from years of constant study and experiment which enable him to perceive correlations and outcomes of plant growth which seem to have been visible to no other man."

DAVID STARR JORDAN,
President of Stanford University.

> "I have called Burbank a botanist because he is one in the highest, the original meaning of the word. Burbank's special field is that of plant genetics; here he is artist as well as scientist. Academic, no—but science is not necessarily bred in the academy. In the application of a knowledge of heredity to the art to which it gives rise in the plant world, his supremacy is unchallenged."

The Old Way—and the New

YEARS ago farming and gardening were "hit or miss" performances. Farmers tried methods because someone else had used them, and but few knew the reasons for any of the operations.

The old way of planning an orchard, a vegetable garden, or a flower garden was to look over a catalogue and order half a dozen of this or a half a dozen of that, especially if the name was attractive, without asking any questions or gaining information as to whether the varieties selected were adapted to the region where they were to be grown. And the old way was to accept the form of plants or trees as they tended to grow, with little or no attempt to change them.

But the new way is to select varieties with the utmost care, paying heed to questions of soil and climate, introducing only such varieties as are adapted to the conditions that must be met.

There is a new pleasure and captivating purpose in farming and gardening through growing plants for more than beauty and usefulness — through growing them to make them take on valuable new forms. The modern plant grower is by no means content to leave everything to nature —he takes a hand himself and helps nature produce the forms or qualities he desires.

One can hardly pick up the day's paper without seeing new evidence of the present-day interest in plant experimentation. In this modern progressive trend, Luther Burbank is by far the foremost exponent. In the field of plant culture and plant improvement he has no peer either in popularity or accomplishment. But there are also gratifying indications that, more and more, others working in the manner of Burbank are producing results that rival even the great plant wizard's accomplishments in particular instances.

Burbank's ways are nature's ways, in which success comes to those who follow them most closely.

Interesting News Items About Recent Burbank Creations

Burbank Has New Flower He Calls "Molten Fire"

SANTA ROSA, CAL., Oct. 8.—On the occasion of a visit this afternoon of Jan Ignace Paderewski, famous musician, to the gardens of Luther Burbank, noted plant creator, announcement was made for the first time of a new Burbank flower creation.

The new creation which Burbank had named "Molten Fire," is a gorgeously colored flower of the poinsetta type, its brilliance eclipsing anything heretofore produced in the flower kingdom, according to those who have seen it.

Paderewski pronounced it the most wonderful flower he had ever seen. The "new amaranthus" is the botanical name given the creation by Burbank.

Lincoln Star.

Large Hulless Oats Perfected

SANTA ROSA, CAL., Jan. 13.—New, white hulless oats that thresh out like wheat and weigh approximately 60 pounds to the bushel instead of 45 pounds, is one of the chief new horticultural productions of Luther Burbank, "plant wizard," just announced.

Pittsburgh Leader.

Thousands of Lives Reported Saved by Burbank Cactus

SANTA ROSA, CAL., Nov. 16.—Lives of thousands of persons in Lutye, the farming regions of India, have been saved by the Luther Burbank spineless cactus, according to Booth Tucker, Commissioner in the Salvation Army, who recently visited Burbank at his home here.

Tucker, who was formerly a judge in India, declared that the planting of the spineless cactus in regions that previously had been periodically ravaged by famine and disease, had solved the problem for

these districts and provided food for thousands who might otherwise have perished.

Red Bluff, Cal., News.

Farmer's Debt to Burbank — Experimenting with Teosinte Grass, the Great Naturalist Produced a Perfect Fodder Plant.

Beginning in 1903, Luther Burbank set about to experiment with teosinte grass in the effort to establish proof of its origin. After 18 years of selecting seeds, he carried teosinte through successive stages of development and produced perfect ears of corn.

Nor is this all of the story. Incidentally, Mr. Burbank created a productive fodder plant. Until now all teosinte had to be raised in southern Florida or some other tropical climate. Through scientific breeding, Mr. Burbank developed varieties of this grass which may be produced profitably as much as 1,000 miles farther north and south of its original home. In the northern States it is now possible to produce fifty times as much fodder as the commonly cultivated teosinte of the South, and fifty times the amount of grain.

La Junta Democrat.

South African Visits Burbank

W. G. Wimshaw, fruit grower of South Africa, was a visitor at the home of Luther Burbank. Wimshaw owns a large part of the Cecil Rhodes farm near Capetown, and discussed the latest developments in fruit growing.

Wimshaw stated that a number of Burbank's creations in fruit had developed well in South Africa.

Santa Rosa Republican.

Fruit from Cacti

The newest achievement of Burbank is the production of cacti that bear fruits beautiful to the eye and with flavors resembling those of peaches, muskmelons, pineapples, etc., yet sufficiently unlike to render them appetizing novelties.

Philadelphia Ledger.

What Others Have Done Working in the Manner of Burbank

—*Why Not You?*

Burbanking Flowers into New Forms of Foliage and New Faces of Beauty Is an Art of Neighbor Pommert of Amelia.

Mr. Chas. Pommert, of Amelia, has propagated a new gladiolus that is said to be pure white. It is called Purity, and is attracting a great deal of attention from leading florists all over the country, and was highly commended by judges at the recent meeting of the Society of American Florists at Washington, D. C.

Batavia, Ohio, Courier.

Second Burbank Has Been Found—Minnesota Farmer Learns How to Color and Flavor Muskmelons.

The discoveries of the marvelous possibilities of horticulture are yet in infancy. Burbank is the pioneer in this department of agriculture. His example has set thousands of expert gardeners to work making tests, the results of some of them being really astounding.

C. W. Marshall, Minneapolis, Minn., has achieved the almost impossible, from the standpoint of the horticulturist, in bringing out seedless varieties of vegetable fruit, and coloring and flavoring muskmelons as desired. "Muskmelons may be flavored easily," he told the growers. "Constant experiment with flowers, vegetables, trees, and plants has led to many an interesting discovery," he says, "with an unending field always open to the one who will spend his time playing cards with those provided by nature."

Findlay Republican.

That "Nine-Acre Farm"—A Preachment on Faith and Accomplishment as Demonstrated by Dr. George M. Twitchell's Little Farm in Monmouth, Me.

(*Arthur C. Staples, in the Lewiston Journal*)

Many hundreds of persons have visited a nine-acre farm in Monmouth, Maine, to see the trees in bearing. It is conducted by Dr. George M. Twitchell of Auburn, Maine.

The plum trees alone are worth a journey to see. Back of them, a little distance, are the apple trees. These carry a burden such as one rarely sees. The great Wolf River apple is one of the loveliest things that grow. It is refined by study and eugenics—and we know not how far it may be carried if such men as Dr. Twitchell, Burbank, and the like go on studying the question of the religion of the soil.

Here are soil, sun, water, air—no other alchemy. There is nothing here that others may not do.

Hand-Pollenization of Flowers Works Miracles in Garden of City's Own "Luther Burbank".

A painter with the earth for his canvas. This is G. W. Dodder, Muscatine's Luther Burbank. He produces flowers of color shades and blends which would drive a painter to madness were he to try to reproduce them on canvas.

His lawn and garden is a thing of beauty, especially in the early morning when the hundreds of varieties and shades of bloom are at their best; and what is best of all to him, most of the rare and exotic blooms are produced by hand pollenizing of the common varieties of flowers.

Some of the old-time favorite fruits and flowers which are now in disfavor with nurserymen and florists contain the best flavors, the most beautiful colorings, and the sweetest aromas, Mr. Dodder claims, and it was from these that the now popular varieties have sprung.

Muscatine, Iowa, Journal.

LUTHER BURBANK

HOW PLANTS ARE TRAINED TO WORK FOR MAN

EIGHT BEAUTIFUL BOUND VOLUMES
2,944 PAGES
110 CHAPTER TITLES
390 FULL COLOR ILLUSTRATIONS
PREFATORY NOTE BY DAVID STARR JORDAN

VOLUME I

PLANT BREEDING

VOLUME II

GRAFTING AND BUDDING

VOLUME III

FRUIT IMPROVEMENT

VOLUME IV

SMALL FRUITS

VOLUME V

GARDENING

VOLUME VI

USEFUL PLANTS

VOLUME VII

FLOWERS

VOLUME VIII

TREES, BIOGRAPHY, INDEX

P. F. COLLIER & SON COMPANY : *Publishers*
NEW YORK

THE UNIVERSITY OF WISCONSIN

MADISON

M. V. O'SHEA
PROFESSOR OF EDUCATION

December 5, 1921.

Dear Mr. Burbank:

Yesterday I received a set of your beautiful books. I have spent a number of hours with them, and they are fascinating and most instructive. Young persons, as well as older ones, will be instructed and delighted by reading these books. The story of your achievements in the improvement of fruits and flowers and vegetables and everything in the plant world reads like a fairy tale. I cannot imagine any person who would not like to read this story.

I congratulate you upon having put what you have accomplished into such form that it will be accessible to people everywhere. I will put them to good use here, for I know I will do my students a service in directing their attention to them.

Cordially yours,

(Signed) M.V.O'Shea

The Evidence—

THE Burbank books were hardly off the press and in the hands of the first readers before evidence began to come in proving beyond question that the great plant breeder's contribution to plant lovers is just as fascinating and helpful to them as the publishers had confidently predicted.

An early, and one of the finest testimonials, was voluntarily submitted by Prof. M. V. O'Shea, Professor of Education at the University of Wisconsin. Professor O'Shea was not only frankly enthusiastic in his praise of the works of Luther Burbank, but was willing that we should include his letter in this booklet as an assurance of their value to prospective owners of the books. Read his letter on the opposite page.

Another interesting and valuable indorsement came from quite a different source—from an amateur gardener, who wrote in part: "These books will certainly be a great benefit to plant improvement, if the people interested in this work will only read them. A man in this business could not make a better investment than to buy a set and read it thoroughly. The methods are explained so clearly and with the help of the many and beautiful illustrations, there is no trouble at all to understand the many subjects described. It is a great work for which the world should feel grateful. I am only an amateur with a small garden, but I am very much interested in this work and I am sure I will learn much from the books."

Such letters as Professor O'Shea's and the amateur gardener's, are most encouraging to the publishers in their efforts to assist Mr. Burbank in preaching the gospel of the soil to plant lovers everywhere.

"It Is a Work for Which the World Should Feel Grateful"

IN the new Burbank books may be found all that the world is eager to know about the author—the interesting story of his long and fruitful life, the secret of his success, his methods and discoveries.

Over fifty years of unparalleled patience and persistence is condensed into eight fascinating volumes.

Beauty

Their beauty in design, binding, and illustration will make them a distinctive feature in any library

Interest

They are excursions into a wonderful land of fact, yet read like stories of the strangest magic. Here for the first time is furnished, in convenient and authoritative form, information concerning the mysteries of nature you have long wondered about.

Practical Value

They are simple, direct, intimate chats with the dean of plant breeders. They teach as well as record the methods that have accomplished the miracles of Burbank fame.

Beautiful and Helpful Color Illustrations

THE profuse color illustrations that beautify and enrich the Burbank books are a vital part of the text, for they show more clearly than words could possibly describe, the actual wonderful developments and improvements Burbank has accomplished. They stand as indisputable evidence of his marvelous achievements; but they do more than this—they show graphically the methods of plant culture recommended by the author, even to such details as the tools used in practical work, the preparation of the soil, the proper processes of transplanting, and the construction of necessary equipment.

Mechanically, no finer examples of the art of color printing could be imagined. The bright, fresh tones of ripe, luscious fruits and berries; the richer and deeper tones of foliage; and the variegated colors of blooming flowers, are as real as in nature. They are not reproductions of paintings, but of photographs taken from living plants—absolutely truthful in form and coloring.

The specimen prints included in this booklet are representative of the 390 full-page color illustrations which appear in the complete set.

These Nature Riddles—

What plant "wears its heart on its sleeve"?
What new food plant is descended from poisonous ancestors?
What flower has the tobacco habit?
Why do not plants cross in a state of nature so as to disrupt the whole order of creation?
How did the peach get its fuzzy coat and why?
What may be regarded as the typical or perfect flower?
Why does the coconut have three eyes?
What is the secret of the jumping bean?
Where do flowers get their colors?
What flower advertises to the flies to act as its messengers of pollination?
Where and how did life start?
What is the purest white in nature?
From what plant was corn evolved, and how did it acquire its present qualities?
How may we account for the fact that bees and other insects have the same taste in color and perfumes that we human beings have?
How far can plant improvement go?
How are new traits in plant life fixed and made permanent?
What was the first form of primitive living organism which appeared on this planet?
Why is it that every native plant growing on the desert is either bitter, poisonous, or spiny?
What plant eats and digests insects?
How can seeds store up the tendencies of their ancestry?
Why should you plant potato seeds instead of eyes to develop new varieties?

—Are Answered by Burbank in His Works and Countless Others Just as Unusual and Interesting

Representative Chapter Titles

THE following representative list, selected from the 110 chapter titles that appear in the complete work, shows how the author treats just the subjects that are full of interest, yet those that meet the outstanding practical problems of plant improvement.

Fundamental Principles of Plant Breeding

How Plants Adapt Themselves to Conditions

Twenty-Three Potato Seeds and What They Taught

Let Us Now Produce Some New Colors in Flowers

Short Cuts into the Centuries to Come

The White Blackberry

The Stoneless Plum

The Winter Rhubarb

Planning a New Plant

Practical Pollination

Grafting and Budding

Fixing Good Traits

Recording Experiments

Hastening Methods of Fruit Improvement

The Thornless Blackberry and Others

Designing a Strawberry to Bear the Year Around

Inedible Fruits Which May Be Transformed

Some Common Garden Plants and Their Improvement

Corn—The King of America's Crops

The Family of Grasses

Chapter Titles—*Continued*

Food for Live Stock

A Rich Field for Work in the Textile Plants

Plants Which Yield Useful Chemical Substances

Reclaiming the Deserts with Cactus

What to Work for in Flowers

Ornamental Palms and Climbing Vines

Lawns and Their Beautification

Nuts as a Profitable Crop

Growing Trees for Lumber

Trees and Shrubs for Shade and Ornament

Working with a Universal Flower—the Rose

The Rivalry of Plants to Please Us

Marvelous Possibilities in the Improvement of Plants

How the Garden May Be Made More Productive

Letting the Bees Do Their Work

Personal and Historical

Patience and Its Reward

Burbank's laboratory is the great out-of-doors. He lives close to the soil and receives new strength from daily contact with it. The only agencies he employs are earth, sun, water, air—no other alchemy; not a thing that the humblest plant lover does not have at his disposal.

These eight beautiful and fascinating volumes should be in every plant lover's library. They are books to *use* as much as they are books to *read*.